

**MMC June 22, 2022 Webinar – Strategic Energy Data Management:  
Understanding and monitoring energy use in municipal buildings - Question and Answer**

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**Slide 6 – Importance of Interval Data at the Building Level**

**Questions for QMC:**

For Natural Gas Meters do many utility providers have pulses available on the main gas meter to obtain interval data? If not readily available, what options are you observing and what are the approximate costs?

- I would estimate about 30% of the natural gas utilities across Canada have the meter modules, policies, and expertise available to provide a pulse output to an energy management system. For example, we have had great success in Ontario with Enbridge and with Fortis in BC. Other utilities do not facilitate this, so we have to supply and install redundant meters.
- insertion gas meters are a good combination of cost, accuracy, and ease of installation. For building level metering, the supply and install cost should be approximately \$4,000 to \$8,000, depending on size of gas line, if any re-piping is needed and if you are combining with other main meter integrations.

What should municipalities know about installing natural gas meters?

- First thing to note is that Measurement Canada regulates natural gas, so if your application is for cost allocation or billing purposes, it will need to be a tested and sealed, in-line gas meter. These are either diaphragm meters for smaller loads or rotary meters for larger loads
- If your application is energy management only, you can use in-line, insertion, or clamp-on meters. In-line will be most cost effective for smaller loads (2" or smaller); you will want to use insertion or clamp-on for larger loads. These last meters may be restricted due to straight pipe requirements
- to properly size a gas meter, you will need to know pipe size, BTU load and pressures. Pressure values are often not factored in, which can cause a 30% or greater error in accuracy

How about water meters same questions as above – pulses at the mains?



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- I would estimate about 15% of the municipal water utilities across Canada have the meter modules, policies, and expertise available to provide a pulse output to an energy management system
- City of Toronto is one of the utilities that does provide this output. You will need to acquire the additional modules for the meter and have the utility install them, but it saves the cost of a redundant meter and the need for a building shutdown.
- You should verify with the utility what output will come from the water meter, as some of these manufacturers only provide a high-frequency pulse output, which are difficult for most energy management systems to read
- Alternatives to integrating with the main meter are in-line meters, insertion, clamp-on pipe, and clamp-on meter devices. All have pros and cons, including lower accuracy but ease of install. We would typically budget \$3,000 to \$6,000 for a building level water meter for a civic centre.

## **Questions for City of Markham**

How common are interval meters in your buildings for i) Electrical, ii) Natural Gas and iii) Water

- All sites with over 200kW should have PowerView/Alectra MyAccount electricity meters. As of 2022, we are eligible for *free* meter upgrades if service is over 50kW or >250,000 kWh/yr.
- 24 meters (+ 1 in progress) through our LDC (Alectra Utilities)
- 1 natural gas meter through Enbridge's EnTRAC\*
- Not aware of any water meters through our utility company
- Installed 1 whole-building electricity meter connected to our central BAS. More underway

How are you using the information they provide?

- This data was extremely useful in tracking real-time energy performance through Markham's Battle of the Buildings Competition. Was hoping to add more electricity and natural gas meters.
- Have used to track how well we shutdown overnight, during COVID lockdowns, and identify equipment being left on.
- Have used to M&V large projects. Ex. Re-commissioning

Which do you find the most useful?

- Electricity because we don't have other meters
- NG meter hasn't been accessible in over a year... still trying to restore access.

## **Slide 11 – Submetering Guidelines**

### **Questions for City of Brampton:**

What motivated you to install a submeter for the refrigeration plant at Terry Miller?

(Context): In 2019, the City of Brampton released the Energy & Emissions Management Plan 2019-2024: A Zero Carbon Transition, which aims to achieve a zero-carbon transition for the City's new and existing corporate facilities. This plan outlines three key objectives: to minimize emissions intensity, to minimize



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energy intensity, and to maximize cost recovery. The City of Brampton aims to substantially reduce and ultimately eliminate GHG emissions by achieving 20% energy reduction over the 2010 baseline by 2024 and GHG emission targets of 30% reduction and 100% reduction for 2030 and 2050, respectively.

- Recreational facilities account for nearly 50% of the City's annual GHG emissions (As per 2019 BPS data 9,321 tonnes of CO<sub>2</sub>e)
- Ice rinks are the largest consumer of electricity within Recreation facilities (Terry Miller's ice rink contributes to approximately 22% of the building's total electricity consumption)
- We cannot manage what we don't measure. To optimize and conserve energy plus to reduce our carbon footprint, we needed to measure electricity consumption in rinks to develop a strategic solution to achieve our targets

How has the City used this data so far?

- The City has used this data to support a Net Zero Ice Rink feasibility study completed at Terry Miller Recreation Centre.
- The sub metered Information is used by our Recreation Operations for planning of their operating budget (i.e., electricity)
- Data is also used to sensitize the operations team of the electricity consumption of the rinks
- This data can also be used for developing baseline and for using measurement and verification of energy conservation measures implemented (ECMs)
- This can also assist us in predictive maintenance of City's assets.

Is the City Contemplating doing this in other buildings? (What else are you thinking of submetering?)

Yes, City is intending to utilize sub metering across its facilities:

- To provide tenant sub metered information as part of its cost recovery, GHG emissions reduction and energy conservation strategy
- To measure and verify energy savings for implemented energy conservation measures

## **Questions for City of Markham:**

Have you installed any submetering in your facilities? If so what loads, if not, are you considering them? Why?

CIMCO refrigeration plant meters – 7

Solar PV meters - 4 to date

Meters on CHP

4 buildings with an advanced sub-metering system include:

- the Civic Centre (2012),
- Cornell Community Centre (2013),
- Pan Am Community Centre (2016), and
- Aaniin Community Centre (2017).

We install an electrical meter on any energy retrofit project that has a total energy cost savings greater than \$10,000 (if possible) for the purpose of tracking energy performance. This simplifies the M&V as well as the reporting process for energy conservation measures. We are now able to monitor 11 energy conservation projects in total

BAS – CTs that can monitor amperage instead of just on/off for similar price.

### **Slide 12 – Submetering Key Considerations**

#### **Questions for QMC:**

What are the key considerations regarding installation, interaction with other equipment (BAS?), and operations of submeters? What are the challenges or items to be aware of as it relates to remote access, security, data storage, etc. IT, security, data, and device interoperability? And expand on them.

The biggest consideration when discussing integration between meters and the building automation system or an energy management system is what protocol needs to be used. Regardless, you will want to ensure any equipment you are supplying is ‘open protocol and non-proprietary.’ For on-site integrations, this would mean using protocols such as Modbus or BACnet; almost all automation companies can integrate with meters using these protocols and most meter manufacturers offer these communications options.

If you are communicating to a cloud-based energy management system, the first challenge is getting the data out of the building. There has been a lot of focus on utilizing the existing building network for this, but we have found that the security, privacy, and bureaucracy challenges involved often delay the project. We have found that cellular solutions allow us to directly communicate with the meters, thereby avoiding any interaction with the base building network. We have used this solution for utilities, bank, and the military, so it is private, secure, and robust.

Once meter data is in the cloud, transferring between software vendors and databases is quite easy using an API

Outside on integration, you want to ensure that the property team, metering provider and automation company have agreed on what parameters they want to record and at what intervals. If these expectations are not aligned before product ordering, the costs to re-program or remove and replace can be very high.

What are the operational considerations of submeters? How often do submeters need to be recalibrated and/or replaced?

Earlier in the presentation we mentioned that Measurement Canada regulates electricity, gas and BTU metering if it's for billing purposes. If the meters installed are for these purposes, then you have legal requirements for reverification; usually every 6 to 10 years.

If it is an energy management metering system, you will want to follow manufacturer recommendations and take into consideration site conditions and the utility type. Most in-line meters are similar to Measurement Canada equipment, so you will only need to reverify after 5 to 10 years. example, insertion water meters.

Which of these seems to be more readily resolvable now than a few years back?

Communications challenges have become easier to manage; we can set up automated alerts when data is down, so you can be more proactive when there is an issue. Remoter connectivity can allow you to assess the meter or communications issue before sending a service technician.

Clamp-on technology continues to improve; it was very inaccurate 5 years ago but with proper calibration and appropriate site conditions, we are seeing 95%+ accuracy.

#### **Question for City of Markham:**

How is it to deal with IT and security given the need to have them involved with this process?

Specifically:

a. What was your experience in installing submetering?

Experience with IT has generally been pretty good. When we were historically installed submeters, working with IT was fine. They would ask questions like if the data would be stored our own servers or an external cloud as that affect how they setup the ports. They would provide us with the IP addresses and help run Ethernet cables to the meters.

With security in higher focus (in the last year or two), I've heard they've now introduced thorough security assessments and it's more difficult to get smart, web-capable devices connected. I haven't personally tried to install new meters in that timeframe so I can't speak directly to the experience. I know we've tried recently to get remote access to BAS vendors, that are installing and commissioning new systems, and have on-going service and maintenance agreements, and that's been mostly unsuccessful so far.... We heard there's a VPN solution coming at the end of this year, so we'll see. So, for troubleshooting or if there's an issue, they have to psychically come on-site... which costs more (minimum truck charge and 3- or 4-hour fee), more coordination, delays, and H&S issue during COVID.

b. What advice would you give someone who is contemplating installing submetering?  
What do you wish you had known?

- Develop an implementation plan with a solid business case. Where you'll need them and when you need them by (i.e., energy competitions, if a major project is planned in the near future and you need baseline and post-project data for M&V).
- Personally, I try to prioritize as many free meters as possible from the utility companies. They install, own, operate, and maintain. My favourite
- Standardized scope, design brand, what type of data you need, stored for how long, at what frequency (15 minute, hourly). Much like BAS, we're running into the situation where there's different login credentials, etc.
- Engage IT early. May need quite a bit of lead time if they have extra security assessments or staffing shortages. Let them know how many meters and where they'll be located so they know where to run Ethernet cables to

**Question for City of Brampton:** (same as above):

How is it to deal with IT and security given the need to have them involved with this process?

The City needed accurate real-time and online sub metered information. As such, IT department was engaged to support online access to the sub metered data while meeting City's IT's security requirements. The support from IT department was necessary and valuable during the implementation of the project (accessing risks and providing guidance with respect to placement of data drops, equipment, and City IT's network usage).

IT and security evaluated the product and made sure that the new product will not bring any risk with it, they also helped to decide the proper placement of these units on the network based on risks presented.

**Slide 21 – BAS – Key Parameters for Optimization**

**Questions for Yorkland Controls:**

Are you seeing a trend to using CTs for status points on motors/AHUs/Pumps compressors etc.?

In most, if not all of, our designs incorporate CTs as status points (on-off) to determine if Fans or compressors or running – for example. We do see a trend with designers asking for the CTs which can actually measure the current when, for example, the fan is running, and then using the automation controller provide the calculation (or in other words a virtual meter) of power consumed. Although not exact, the calculation overtime can be used for establishing a reference for energy benchmarking purposes.

What is the cost difference of CTs versus status point when VFDs are not available/applicable?

The differences in cost between an ON/OFF CT and one that can measure current is insignificant., but there is potentially extra work at the BAS to calculate the power and then visualize it on a trend.

**Slide 28 – Establishing a Process to Use Data**

**Questions for Yorkland Controls:**

What trends are you seeing in the uptake for FDD?

We are seeing the shift from education to implementation. 5-10 years ago, we were in the position of educating building owners and operators on the “new” building technology called Fault Detection and Diagnostics. Now most people know of the concept and are more interested in how they can implement it in their operations.

We are seeing more building owners and operators leading the way as champions of the concept as they recognize the value in not only energy savings but operational savings

In the last two years, the focus has been on using FDD to ensure their buildings and spaces are safe for occupants. Management of air quality is top of mind as companies return to full occupancy. Many are seriously considering using people counting technology into their FDD so that they can monitor, and control air quality based on the actual number of people in the space, and then ventilate at a CFM per person. Some are using the savings of demand control ventilation to help with the payback.

More uptake in building owners being champions. Change from educational to putting it in practice

For those that are successful with it, what processes do they have in place? In your experience, what makes FDD successful?

Have a champion or project manager – someone who will lead the effort. Typically, the information involved will come from multiple areas of responsibility in an organization. The Champion/Project Manager leads the effort to identify the data sources and methods of acquiring the data.

The most successful projects start small or with a pilot project and build on from there. A project might focus on using a small amount of data from a large number of sites or a more thorough application of analytics to major equipment systems in a single facility. Work on the low hanging fruit that is easily fixed first and prioritize the rest of the issues according to resources available to resolve them.

Don't feel you have to connect all your systems all at once. You can start with an excel spreadsheet with your energy data and a few pieces of equipment. You don't even need a BAS. You also don't need to apply a ton of rules all at once. This can easily overwhelm staff and leads to ignoring the fault notifications.



Are you seeing more firms providing services to monitor and prioritize?

This really depends on the company and the in-house capabilities. Some companies have their own automation techs and programmers, or energy managers. Some companies have limited staff and time to champion their projects themselves and hire out that service. Typically, we see a blend of both on most projects. We get them started with prioritizing their equipment and the fault detection rules and then a 3<sup>rd</sup> party firm provides their services to work with them to monitor and analyze the faults detected and plan a resolution of them.